THURSDAY, AUGUST 6, 1903.

THE MINERAL WEALTH OF AFRICA.

Les Richesses Minérales de l'Afrique. By L. de Launay. Pp. 395; with 71 figures and maps. (Paris: Ch. Béranger, 1903.) Price 20 francs.

PROF. DE LAUNAY gives a further proof of his indefatigable industry in this new volume from his pen. It is a formidable task to deal even briefly with the mineral wealth of a huge continent, which has been only imperfectly explored; but fortunately the author is eminently qualified for the task. He is no novice in writing upon mineral deposits, and he has visited many mines in North Africa, besides the most important districts in the south. The book is arranged so as to suit two classes of readers, those who wish to learn all they can about the occurrence of some given mineral, such as gold, copper ore, phosphate of lime, &c., and those whose interest relates only to some particular country or region. This arrangement involves a certain amount of duplication, but it is certainly a convenience. Thanks are likewise due to the author for his little sketch maps. Who has not experienced the want of such maps? For when seated in an easy chair the reader is apt to be too lazy to get up and fetch his atlas, and he consequently often fails to derive full benefit from the work he is perusing.

What is the mineral wealth of South Africa? Of the future mineral resources of the Dark Continent we are ignorant; further explorations may reveal new treasures; but if by "mineral wealth" is understood the value of the present output, the question is answered by the following tables, which have been compiled from the Blue-books published annually by the Home Office. Though the information is necessarily incomplete, it will suffice for the purposes of the present article.

In a normal year, such as 1898, gold is seen to be far ahead of any other mineral as regards value; and when we consider that before the war with the Boers Africa was furnishing more than one quarter of the world's supply of the precious metal, it is evident that Prof. de Launay is fully justified in devoting his first chapter to a description of the auriferous deposits of the continent. The gold mines of the Witwatersrand naturally claim a full share of attention. Excellent figures, with full descriptions, explain the nature of the "banket" or gold-bearing conglomerate, and the question of the origin of the gold is discussed at some length. The three usual hypotheses are brought forward; they may be spoken of briefly as "previous origin," "contemporaneous origin," and "subsequent origin." In other words, it is supposed by some geologists that the gold is a detrital product, like the pebbles of quartz; others suggest that it was deposited from solutions while the pebbles were finding a resting place; whilst most mining engineers favour the idea that solutions brought it into the conglomerates long after their consolidation. The pros and cons are given in each case; however, there are difficulties in accepting any one of the three theories advanced, and Prof. de Launay honestly confesses that he is puzzled, and that he cannot make up his mind on the matter.

He is careful to point out that the Rand must be regarded as an exceptional case, and that it by no means follows from the discovery of "banket" in West Africa that the "Jungle" gold mines, as they are known on the Stock Exchange, will necessarily prove to be rich and valuable properties.

The pages relating to the occurrence of gold in Egypt contain matter of much antiquarian interest; the public are only now beginning to learn that Egypt was the California of the Old World, and that gold was being extracted from quartz veins between the Nile and the Red Sea at least 2500 years B.C. But the author makes a mistake in saying that the gold occurs under conditions similar to those under which it is found in *Cornwall.* In that county we have no auriferous deposits, for the small grains of the precious metal occasionally found in working stream tin in olden days were, practically speaking, mineralogical curiosities.

Next in importance come diamonds; for though the emeralds of Gebel Sabara and the turquoises of Sinai were known and worked by the ancients, the only gem-mining which need be taken into consideration at the present time is that of South Africa. It is a curious fact, on a continent in which both gold and gems were obtained in considerable quantities even in very remote ages, that the deposits which are now yielding so lavishly should have remained undiscovered until the latter part of the last century. The mode of occurrence of diamonds in South Africa is thoroughly well known to geologists; but the precise manner in which they were originally formed still affords room for speculation. Prof. de Launay repeats the hypothesis, already suggested in his previous work, "Les Diamants du Cap," that a bath of supercarburetted molten iron and magnesium existed beneath the granite, and that the diamonds were formed on a large scale after the fashion of the minute ones obtained artificially by Moissan.

The discovery of workable deposits of phosphate of lime is one of recent date; it now appears that they extend more or less continuously from Morocco to Egypt. Algeria already produces more than 300,000 tons a year, and Tunisia more than 200,000 tons from strata of Eocene age. The Egyptian deposits, which occur in Upper Cretaceous rocks, are extensive but poor.

There are reasons for believing that the dry Sahara and Algeria may contain deposits of nitrate of potash and nitrate of soda similar to the "caliche" of Chili; the matter is now being investigated officially.

Practically speaking, all the copper of Africa comes from Namaqualand; the advent of better means of transport may render this statement incorrect in the course of a few years, for ores of the metal are known to exist in many parts of the continent.

Coal of Permo-triassic age is worked in the Transvaal, Natal, and Cape Colony, and Rhodesia will soon become a producer.

The total value of all the minerals produced in

AFRICA.—*Output and Value of*

Mineral	Abyssinia		Algeria		Cape Colony		French Soudan		German E. Africa		Gold Coast		Madagascar	
	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £
Antimony Ore ...	—	—	136	883	—	—	—	—	—	—	—	—	—	—
Asbestos	—	—	—	—	149	2,037	—	—	—	—	—	—	—	—
Brown Coal ...	—	—	197	96	—	—	—	—	—	—	—	—	—	—
Clay	—	—	77,447	12,415	—	—	—	—	—	—	—	—	—	—
Coal	—	—	—	—	171,301	135,851	—	—	—	—	—	—	—	—
Copper Ore ...	—	—	—	—	36,822	310,636	—	—	—	—	—	—	—	—
Crocidolite... ...	—	—	—	—	8	700	—	—	—	—	—	—	—	—
Diamonds (carats)...	—	—	—	—	3,270,917 [carats	4,128,321	—	—	—	—	—	—	—	—
Fireclay	—	—	—	—	1,240	not stated	—	—	—	—	—	—	—	—
Flags	—	—	6,271	2,701	—	—	—	—	—	—	—	—	—	—
Garnets	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Gold (ounces) ...	—	—	—	—	127 oz.	444	2,700 oz.	11,560	—	—	17,733 oz.	63,838	—	—
Gypsum	—	—	148	15	—	—	—	—	—	—	—	—	—	—
Iron ore	—	—	466,089	140,733	—	—	—	—	—	—	—	—	—	—
Lead Ore	—	—	118	624	—	—	—	—	—	—	—	—	—	—
Limestone	—	—	25,565	24,957	—	—	—	—	—	—	—	—	—	—
Marble	—	—	969	6,001	—	—	—	—	—	—	—	—	—	—
Onyx	—	—	216	2,497	—	—	—	—	—	—	—	—	—	—
Phosphate of Lime	—	—	265,145	215,600	—	—	—	—	—	—	—	—	—	—
Plaster	—	—	29,280	22,117	—	—	—	—	—	—	—	—	—	—
Potter's Clay ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Salt	—	—	20,966	17,193	11,850[1] 442,380 [bushels	32,598	—	—	—	—	—	—	—	—
Sand and Gravel ...	—	—	71,045	3,143	—	—	—	—	—	—	—	—	—	—
Silver Lead Ore ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Stone, Building ...	—	—	727,349	69,766	—	—	—	—	—	—	—	—	—	—
,, Rough ...	—	—	674,663	37,843	—	—	—	—	—	—	—	—	—	—
Tin Ore	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc Ore	—	—	29,304	56,268	—	—	—	—	—	—	—	—	—	—
Total ...	—	—	—	612,852	—	4,610.587[3]	—	11,560	—	—	—	63,838	—	—

[1] Estimated at 60 lb. = 1 bushel.

[3] Total incomplete.

AFRICA.—*Output and Value of*

Mineral	Abyssinia		Algeria		Cape Colony		French Soudan		German E. Africa		Gold Coast		Madagascar	
	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £
Antimony Ore ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Asbestos	—	—	—	—	88	1,433	—	—	—	—	—	—	—	—
Brown Coal ...	—	—	210	102	—	—	—	—	—	—	—	—	—	—
Clay	—	—	117,312	17,040	—	—	—	—	—	—	—	—	—	—
Coal	—	—	—	—	205,810	180,413	—	—	—	—	—	—	—	—
Copper Ore... ...	—	—	7,152	5,035	45,356	613,739	—	—	—	—	—	—	—	—
Crocidolite ...	—	—	—	—	3	150	—	—	—	—	—	—	—	—
Diamonds (carats)...	—	—	—	—	2,781,385 [carats	5,387,955	—	—	—	—	—	—	—	—
Fireclay	—	—	—	—	900	not stated	—	—	—	—	—	—	—	—
Flags	—	—	8,218	3,424	—	—	—	—	—	—	—	—	—	—
Garnets	—	—	—	—	—	—	—	—	not stated	2,750	—	—	—	—
Gold (ounces) ...	31,161 oz.[1]	139,600	—	—	78 oz.	302	—	—	—	—	6,162 oz.	22,187	33,600 oz.	112,860
Gypsum	—	—	591	60	—	—	—	—	—	—	—	—	—	—
Iron Ore	—	—	506,347	198,679	—	—	—	—	—	—	—	—	—	—
Lead Ore	—	—	1,588	4,383	—	—	—	—	—	—	—	—	—	—
Limestone	—	—	26,574	25,500	—	—	—	—	—	—	—	—	—	—
Marble	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onyx	—	—	289	3,352	—	—	—	—	—	—	—	—	—	—
Phosphate of Lime	—	—	260,815	212,000	—	—	—	—	—	—	—	—	—	—
Plaster	—	—	34,191	26,397	—	—	—	—	—	—	—	—	—	—
Potter's Clay ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Salt	—	—	18,226	15,995	not stated	not stated	—	—	—	—	—	—	—	—
Sand and Gravel ...	—	—	85,357	3,774	—	—	—	—	—	—	—	—	—	—
Silver Lead Ore ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Stone, Building ...	—	—	785,948	73,744	—	—	—	—	—	—	—	—	—	—
,, Rough ...	—	—	1,413,566	56,550	—	—	—	—	—	—	—	—	—	—
Tin Ore	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc Ore	—	—	26,488	52,704	—	—	—	—	—	—	—	—	—	—
Total ...	—	139,600	—	698,739	—	6,183,992[5]	—	—	—	2,750	—	22,187	—	112,860

[1] 2,710 ounces of fine silver are contained in the gold.
[5] Total incomplete.

inerals in the year 1898.

Natal		Orange River Coly.		Portug. E. Africa		Rhodesia		Senegal		Transvaal		Tunis		Total	
uantity at. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £
—	—	—	—	—	—	—	—	—	—	—	—	—	—	136	833
—	—	—	—	—	—	—	—	—	—	—	—	—	—	149	2,037
—	—	—	—	—	—	—	—	—	—	—	—	—	—	197	96
—	—	—	—	—	—	—	—	—	—	—	—	—	—	77,447	12,415
387,811	75,015	—	—	—	—	—	—	—	—	1,907,809	668,346	—	—	2,466,921	879 212
—	—	—	—	—	—	—	—	—	—	—	—	—	—	36,822	310,636
—	—	—	—	—	—	—	—	—	—	—	—	—	—	8	700
—	—	288,937 [carats	498.797	—	—	—	—	—	—	22,843 [carats	43,730	—	—	3,582,697 [carats	4,670,848
—	—	—	—	—	—	—	—	—	—	—	—	—	—	1,240	not stated
—	—	—	—	—	—	—	—	—	—	—	—	—	—	6,271	2,701
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17 oz.	60	—	—	—	—	22,911 oz.	83,053 [2]	4,147 oz.	15,464	3,830,337 [oz.	16,240,630	—	—	3,877,972 oz	16,415,049
—	—	—	—	—	—	—	—	—	—	—	—	10,629	not stated	10,777	15
—	—	—	—	—	—	—	—	—	—	—	—	—	—	466,089	140,733
—	—	—	—	—	—	—	—	—	—	—	—	2,337	7,536	2,455	8,160
—	—	—	—	—	—	—	—	—	—	—	—	—	—	25,565	24,957
—	—	—	—	—	—	—	—	—	—	—	—	591	not stated	1,560	6,001
—	—	—	—	—	—	—	—	—	—	—	—	—	—	216	2,497
—	—	—	—	—	—	—	—	—	—	—	—	—	—	265,145	215,600
—	—	—	—	—	—	—	—	—	—	—	—	—	—	29.280	22,117
—	—	—	—	—	—	—	—	—	—	—	—	5,708	not stated	5,708	not stated
—	—	—	—	—	—	—	—	—	—	—	—	7,185	6,424	40,001	56,215
—	—	—	—	—	—	—	—	—	—	—	—	—	—	71,045	3,143
—	—	—	—	—	—	—	—	—	—	80	500	—	—	80	500
—	—	—	—	—	—	—	—	—	—	—	—	290,341	not stated	1,017,690	69,766
—	—	—	—	—	—	—	—	—	—	—	—	65,942	not stated	740,605	37,843
—	—	—	—	—	—	—	—	—	—	23	1,800	—	—	23	1,800
—	—	—	—	—	—	—	—	—	—	—	—	21,419	43,268	50,723	99,536
—	75,075	—	498,797	—	—	—	83,053	—	15,464	—	16,955,006	—	57,228[3]	—	22,983,460

[2] This total is made up of gold declared to August 31, 1898, viz., 6,533 oz., and gold produced from September to December, 1898, 16,378 oz.

Minerals in the year 1901.

Natal		Orange River Coly.		Portug. E. Africa		Rhodesia		Senegal		Transvaal		Tunis		Total	
Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £	Quantity Stat. Tons	Value £
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	88	1,433
—	—	—	—	—	—	—	—	—	—	—	—	—	—	210	102
—	—	—	—	—	—	—	—	—	—	—	—	—	—	117,312	17,040
569 200	549,439	—	—	—	—	—	—	—	—	468,162 [2]	201,634	—	—	1,243,179	931,486
—	—	—	—	—	—	—	—	—	—	—	—	—	—	52,508	618,774
—		—	—	—	—	—	—	—	—	—	—	—	—	3	150
—	—	—[4]	—	—	—	—	—	—	—	—	—	—	—	2,781,385 [carats	5,387,955
—		—	—	—	—	—	—	—	—	—	—	—	—	900	not stated
—		—	—	—	—	—	—	—	—	—	—	—	—	8,218	3,424
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2,750
135 oz.	531	—	—	13,632 oz.	52,577	172,035 oz.	623,627	—	—	230,801 [3] [oz.	980,381	—	—	487,604 oz.	1,932,065
—	—	—	—	—	—	—	—	—	—	—	—	—	—	591	60
—	—	—	—	—	—	—	—	—	—	—	—	—	—	506,347	198,679
—	—	—	—	—	—	—	—	—	—	—	—	8,070	26,760	9 658	31,143
—	—	—	—	—	—	—	—	—	—	—	—	34,250	29,635	60,824	55,135
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	289	3,352
—	—	—	—	—	—	—	—	—	—	—	—	169,653	105,700	430,468	317,700
—	—	—	—	—	—	—	—	—	—	—	—	12,779	24,078	46,970	50,475
—	—	—	—	—	—	—	—	—	—	—	—	6,274	300	6,274	300
—	—	—	—	—	—	—	—	—	—	—	—	16,633	14,880	34,859	30,875
—	—	—	—	—	—	—	—	—	—	—	—	—	—	85,357	3,774
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	860,004	61,251	1,645,952	134,995
—	—	—	—	—	—	—	—	—	—	—	—	—	—	1,413,566	56,550
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	17,617	43,240	44,105	95,944
	549,970	—	—	—	52,577	—	623,627	—	—	—	1,182,015	—	305,844	—	9,874,161

[2] Output for the last four months of the year only.

[3] Output for the last six months of the year only.

[4] No work was done at the Jagersfontein Mine during the financial year ended March 31, 1902. The output for the financial year ended March 31, 1901, was 18,002 carats, valued at 37,079*l*.

Africa in 1898 was about 23 millions sterling. This amount seems small for the huge continent, when we reflect that in 1901 the coal output of Wales alone was worth 19½ millions, and that of Northumberland and Durham about the same amount. But after reading Prof. de Launay's book, it needs no prophet to predict that Africa's mineral deposits will soon be more largely utilised.

ROWLAND'S WORK.

The Physical Papers of Henry Augustus Rowland. Collected for publication by a Committee of the University. Pp. xi + 704. (Baltimore: Johns Hopkins University Press; London: Wesley and Son, 1902.) Price 30*s.* 6*d.* net.

PROF. ROWLAND'S friends have been well-advised in issuing as a memorial to their late colleague this volume of his collected papers. It enables us to realise more fully all we owe to him and to grasp the value and importance of his work.

Commencing with an early note sent to the *Scientific American* when the author was seventeen, the list of scientific papers concludes with an article on diffraction gratings, published in the new edition of the "Encyclopædia Britannica" after Rowland's death. Then there follow some six addresses on scientific subjects, a bibliography, and an account of the dividing engines he designed.

Dr. Mendenhall's commemorative address, delivered shortly after Rowland's death, fitly forms an introduction to the whole, and gives us a glimpse of his life and methods of work.

Rowland's fame came to him early, though not without some severe struggles and disappointments on his part, and it is a satisfaction to us Englishmen to know that it was Maxwell who first recognised his genius. Prof. Mendenhall tells again the story of his first serious paper, "On Magnetic Permeability and the Maximum of Magnetism of Iron, Steel, and Nickel," *Phil. Mag.*, 1873. The paper was more than once rejected in America because it was not understood, and finally it was sent to Maxwell, who wrote immediately that since the temporary suspension of their meetings made it impossible to communicate the paper to the Royal Society, he would send it to the *Philosophical Magazine*, where it appeared in August, 1873, Maxwell having himself, to save time, corrected the proofs. In this paper Rowland introduced the idea of the magnetic circuit as the analogue of Ohm's law, and developed the now well-known ring method of measuring permeability. In 1875, on his appointment as first professor of physics at the Johns Hopkins University, he came to Europe and worked for a time in Helmholtz's laboratory at Berlin, and by his researches answered Tait's question, put to Maxwell in these words—

Will mounted ebonite disc
  On smooth unyielding bearing,
When turned about with motion brisk
  Nor excitation sparing,
Affect the primitive repose
  Of + and − in a wire?

To which Maxwell replies—

The mounted disc of ebonite
  Has whirled before nor whirled in vain,
Rowland of Troy that doughty knight
  Convection currents did obtain
In such a disc of power to wheedle
  From its loved North the subtle needle.

And Maxwell goes on to explain that such convection currents will not produce electromotive force in a neighbouring wire unless the speed of the disc were variable.

The paper on the "Magnetic Effect of Electric Convection," No. 12, in the volume before us, was presented in the *American Journal of Science* for 1878; von Helmholtz had already announced the result to the Berlin Academy in 1876. Rowland returned to the problem with the same result in 1889, in a paper presented in the *Philosophical Magazine,* No. 43 of his collected works. As is well known, the results were challenged by Crémieu shortly before Rowland's death. Many readers of NATURE will remember the interesting occasion in Section A of the British Association at Glasgow, when Crémieu described how he had failed to obtain the effect. Those present felt that in view of the confirmation of Rowland's results obtained at Baltimore by Pender, Crémieu must have been misled, but no one could put his fingers definitely on the error. It is satisfactory to know, from the recently published joint work of Crémieu and Pender, that Rowland was right, and that a convection current of electricity does produce a magnetic field.

The research into the value of the British Association unit of resistance, No. 15, and a determination of the value of "*v*," No. 44, complete the series of fundamental electrical researches, though his collected papers contain many other memoirs of real importance.

In his experiments on the absolute unit of resistance, Rowland shows his usual acumen as a critic and skill as a mechanic and observer. Various lines of argument had shown that the B.A. unit, supposed to represent 10^9 C.G.S. units of resistance, was in error. Rowland sums up effectively his criticisms on the method of the B.A. committee and points out the sources of error in Weber's method by damping adopted by Kohlrausch. He then describes his own method, a modification of that originally proposed by Kirchhoff, and, after a careful account of his apparatus and measurements, arrives at the result 1 B.A. unit $= 0{\cdot}9911 \times 10^9$ C.G.S. units. A repetition of his experiments in 1884 gave 0.98627, while about the same time his pupil, Kimball, using Lorenz's method, arrived at the result 0·9864. The value obtained at the Cavendish Laboratory was 0·9867.

Part iii. of the collected papers deals with the work on Heat, and foremost among these is the great memoir on the "Mechanical Equivalent of Heat," a work which, if it stood alone, would have made Rowland's name as the foremost physicist of his nation.

The refinements of modern thermometry have enabled us to introduce some small corrections into certain of the results, but the work remains unrivalled.